

**REMARKS/ARGUMENTS**

The Office Action of July 14, 2003 has been reviewed and considered. In the Office Action, claims 1-20 were rejected under 35 U.S.C. §102. Claims 9 and 10 were also rejected under 35 U.S.C. §112, second paragraph.

Claims 1 and 3-20 have been amended. Claim 2 has been cancelled. Claims 1 and 3-20 remain pending. Reconsideration of the application is requested.

Claims 9 and 10 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite. Claim 9 has been amended to more clearly recite that the tool can include at least one layer of material between the carbon layers. Claim 10 has been amended to more clearly recite that the tool can include a layer of material that is spaced from the substrate by at least the second carbon layer. Support for these amendments is found, at least, on page 6 of the original specification. No new matter has been added. Withdrawal of the rejection is requested.

An aspect of the present invention includes a coated tool used for machining. The coated tool comprises a substrate that has a predetermined coefficient of thermal expansion. The coated tool also comprises a first carbon layer deposited on the substrate and a second carbon layer deposited so that it is spaced from the substrate by at least the first carbon layer. The first carbon layer has a predetermined highly predominant fraction of 80-100% of carbon with a diamond crystal structure and a coefficient of thermal expansion which is smaller than the coefficient of thermal expansion of the substrate. The second carbon layer has a fraction of carbon with a diamond crystal structure that is 80-100% but lower than the predetermined fraction of carbon with a crystal diamond structure in the first carbon layer. Additionally, the second carbon layer

(1) has a coefficient of thermal expansion that is greater than the coefficient of thermal expansion of the first carbon layer, and (2) consists of nano-crystalline diamond.

The second, outside carbon layer has a lower fraction of carbon, because it consists of nano-crystalline diamond (the lower fraction of carbon is due to the increased influence of grain boundaries as the grains get smaller, as explained on page 16, third paragraph of the original specification). The second, outer layer has a greater coefficient of thermal expansion. Also, by this construction, improved adhesion is achieved by the additional compressive stress exerted by the second carbon layer (as explained on page 5, second paragraph of the original specification).

Claims 1-3, 5-8, 11-13, 15 and 17-20 have been rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,063,149 to Zimmer. The patent to Zimmer relates to diamond coatings for wear tools and parts. The patent discloses controlled process conditions that are intended to produce polycrystalline coatings having progressively finer grain size in the direction of the outer surface. For example, the Zimmer patent states, "the first region then transitions into a graded layer of polycrystalline diamond wherein the diamond grains become progressively smaller towards the outer surface" (column 3, lines 44-47). The only reference to the specific size of diamond crystallites is "substantially less than 3 microns." (column 3, line 48).

While the patent to Zimmer teaches to first apply a "conventional" layer of polycrystalline diamond, it clearly does not disclose applying a diamond coating with nano-crystalline diamond. Therefore, the patent to Zimmer does not teach applying a "second" carbon layer consisting of nano-crystalline diamond. Similarly, the patent to Zimmer does not teach to provide a separate layer, consisting completely of nano-crystalline diamond. As explained in the

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specification of the Zimmer Patent and shown in corresponding Figure 2, the proposed “graded grain size diamond layer” transitions from large crystallites (grains) to smaller crystallites. This transition has no clear distinction between layers, but instead, is continuous. Therefore, the diamond coating disclosed in the patent to Zimmer is quite different from the diamond coating recited in amended claim 1.

As discussed, the patent to Zimmer clearly fails to disclose a second layer consisting completely of nano-crystalline diamond. As is well settled, a publication cannot anticipate a claim if it does not teach each and every element recited in the pending claim. Therefore, the patent cannot anticipate the pending claims because it fails to teach all that is recited in the pending claims. Withdrawal of the rejection is requested.

Claims 1-9 and 11-20 have been rejected under 35 U.S.C. §102(e) as being anticipated by EPO Publication No. EP 0 752 293 to NGK Spark Plug Co. (NGK); EPO Publication No. EP 0 596 619 to Crystallume; or Japanese Publication No. JP 04 223806 to Mitsubishi Materials (Mitsubishi).

#### PUBLICATION TO NGK

The publication to NGK discloses a diamond coated article and a method of forming the article. The publication also discloses that the article can include multiple poly-crystalline diamond film layers. Each of these layers is disclosed to have a thickness of between 6 to 13  $\mu\text{m}$ . Neither of the layers consists of nano-crystalline diamond as recited in claim 1. Additionally, the publication fails to disclose (1) the fraction of carbon percentages and (2) the relative coefficients of thermal expansion recited in the pending claims. As a result the

publication to NGK cannot anticipate the pending claims because, as discussed, it does not disclose all that is recited in the pending claims. Withdrawal of the rejection is requested.

**PUBLICATION TO CRYSTALLUME**

The publication to Crystallume discloses a diamond coated article with an integral wearout indicator. The diamond coated article comprises first and second layers of an electrically-conductive diamond layer. The first diamond layer is disclosed to have a thickness between 2 microns and 5 microns. The second diamond layer is disclosed to have a thickness between 20 microns and 30 microns. Like the NGK publication, the Crystallume publication does not disclose that the second layer consists of nano-crystalline diamond as recited in the pending claims. Also, the publication fails to disclose (1) the fraction of carbon percentages and (2) the relative coefficients of thermal expansion recited in the pending claims. As a result the publication to Crystallume cannot anticipate the pending claims because, as discussed, it does not disclose all that is recited in the pending claims. Withdrawal of the rejection is requested.

**PUBLICATION TO MITSUBISHI**

The like above-discussed publications, the publication to Mitsubishi fails to anticipate the pending claims. The publication to Mitsubishi discloses two layers of diamond coating. It does not recite that either of these layers consists entirely of nano-crystalline diamond. Therefore, the publication cannot disclose that the second layer, which is spaced from the substrate, consists of nano-crystalline diamond as recited.

Additionally, the publication fails to disclose the recited fraction of carbon with crystal diamond structure of the first layer. Moreover, the publication does not disclose that the first

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carbon layer has a coefficient of thermal expansion that is less than the coefficient of thermal expansion of the substrate. Similarly, the publication to Mitsubishi fails to disclose that the second carbon layer (1) has a fraction of carbon that is 80-100%, but lower than that of the first carbon layer; and (2) has a coefficient of thermal expansion that is greater than the coefficient of thermal expansion of the first carbon layer. Therefore, the publication fails to disclose all that is recited in the pending claims and, thus, cannot anticipate the pending claims. Withdrawal of the rejection is requested.

Claims 1-20 have been rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,139,372 to Tanabe et al.

The patent to Tanabe discloses a polycrystalline diamond tool that includes a plurality of diamond layers that provide the tool with a non-uniform quality along its thickness. The layers include diamond having a diameter of at least 10  $\mu\text{m}$ . Therefore, the diamond layers disclosed by Tanabe are not formed so that that a second layer consists of nano-crystalline diamond. Additionally, the patent to Tanabe fails to expressly disclose the recited fraction of carbon percentages and the recited relative thermal expansions. As a result, the patent to Tanabe cannot disclose the tool recited in claim 1, the method recited in claim 11 or any of the dependent claims. Withdrawal of the rejection is requested.

Claims 1-3, 5-8, 11-13, 15 and 17-20 have been rejected under 35 U.S.C. §102(b) as being anticipated by Japanese Publication No. JP 05 023993 to Mitsubishi Materials (Mitsubishi). The publication to Mitsubishi layers of diamond coating. It does not disclose a first layer that includes the recited fraction of carbon with crystal diamond structure. Also, it clearly does not disclose that the first carbon layer has a coefficient of thermal expansion that is

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less than the coefficient of thermal expansion of the substrate. Further, the publication fails to disclose a second carbon layer that (1) has a fraction of carbon that is 80-100%, but lower than that of the first carbon layer; (2) has a coefficient of thermal expansion that is greater than the coefficient of thermal expansion of the first carbon layer; and (3) consists of nano-crystalline diamond.

As is well settled, a publication cannot anticipate a claim if it does not teach each and every element recited in the pending claim. Therefore, since the publication to Mitsubishi fails to disclose the above-discussed recitations of the pending claims, it cannot anticipate the claims. Hence, withdrawal of the rejections is requested.

The Office Action submits that the recited relative thermal expansion of the substrate and the two carbon layers is thought to be inherent. Applicants submit that without some showing of why the recited thermal expansions are inherent, a prima facie case of anticipation has not been, and cannot be, set forth. If the above rejections are maintained, evidence as to why the relative thermal expansions are inherent is required.

For all of the above-discussed reasons, Applicants respectfully submit that claims 1 and 3-20 are allowable and that the application is now in condition for allowance. A notice to this effect is earnestly solicited.

If any questions or issues remain, the resolution of which the Examiner feels would be advanced by a conference with Applicants' attorney, the Examiner is invited to contact Applicants' attorney at the number noted below.

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If any fees are required with this submission, the Commissioner is authorized to charge such fees to deposit account No. 19-0733.

Respectfully submitted,

BANNER & WITCOFF, LTD.

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